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Indian Standard

SPECIFICATION FOR MEN'S WOOL-COTTON UNDERPANTS

(*First Revision*)

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NEW DELHI 110002

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June 1980

Indian Standard

SPECIFICATION FOR MEN'S WOOL-COTTON UNDERPANTS

(First Revision)

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Indian Standard

SPECIFICATION FOR MEN'S WOOL-COTTON UNDERPANTS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 January 1980, after the draft finalized by the Hosiery Sectional Committee had been approved by the Textile Division Council.

0.2 This standard, which was published in 1969, has been taken up for revision to define the grade of wool tops used for spinning the worsted yarn, and to include the requirement of scouring loss of underpants.

0.3 To familiarize the industry with International System of Units (SI Units), the basic SI Units as well as the recommended SI Units for use in the textile industry are given in Appendix B.

0.3.1 Standards of Weights and Measures Act 1976 also stipulates use of SI Units.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the constructional details and other particulars of scoured or bleached wool-cotton rib-knitted underpants.

NOTE — The description ' wool-cotton ' indicates that underpants are made with worsted yarn and cotton yarn, in such a way that the cotton yarn shall appear in the middle of two layers of wool yarn due to rib construction. The proportion of the worsted yarn and cotton yarn in the fabric shall be 55 and 45 percent by mass respectively except the bottoms of the legs, which would be knitted with worsted yarn only. The mass of this portion is approximately 40 g.

---

*Rules for rounding off numerical values (*revised*).

1.2 This standard does not specify the general appearance, feel, shade, etc, of the underpants (*see also* **4.4**).

2. MATERIAL

2.1 Worsted Yarn — The worsted yarn used for knitting underpants shall be spun from wool tops of not less than 58s grade. The approximate count of yarn shall be 40 tex (Nm 25) and the single thread breaking load value shall not be less than 1 225 mN (125 gf) (*see* Notes 1 and 2).

NOTE 1 — The breaking load of yarn shall be determined on a test length of 500 mm using a constant rate of traverse type machine having a traverse of 300 ± 15 mm per minute. (*see also* IS : 1670-1970*).

NOTE 2 — The breaking load values of the yarn removed from the knitted fabric shall not be less than 95 percent of the specified value.

2.2 Cotton Yarn — The cotton yarn used in plaiting of underpants shall be evenly spun. The approximate count of yarn shall be 18^s (32 tex) and the single thread breaking load shall not be less than 2 200 mN (225 gf) (*see* Notes 1 and 2 *under* **2.1**).

2.3 Cotton Calico — conforming to IS : 1544-1973†.

2.4 Cotton Tape — 20 mm wide and 30 cm longer than the corresponding waist girth and conforming to Variety 7 of IS : 1895-1970‡.

2.5 Cotton Sewing Threads — bleached, of 24s/3 (250 dtex × 3), 40s/2 (145 dtex × 2) or 60s/3 (100 dtex × 3) count and conforming to IS : 1720-1978§.

3. MANUFACTURE

3.1 In shape, the underpants shall generally be as shown in Fig. 1. The underpants shall be tailored neatly out of well and evenly knitted fabric (*see* **3.1.1**). The wales shall run along the length of the underpant. The two halves of the underpant shall be uniform in texture, shade and appearance. The underpants shall not have any seams and joinings along their two sides.

3.1.1 The underpants shall be knitted in the following two distinct operations:

a) Legs and top in 1 × 1 rib stitches; and

b) Bottoms, 15 cm in depth, knitted integrally in 2 × 2 rib stitches using 2-ply worsted yarn only.

---

*Method for determination of breaking load, elongation at break and tenacity of yarns (*first revision*).

†Specification for cotton calico, bleached or dyed (*first revision*).

‡Specification for cotton tape *NEWAR*, grey or dyed (*first revision*).

§Specification for cotton sewing threads (*second revision*).

3.2 Waist-Band — At the waist of the underpants, the raw edge of the knitted fabric shall be turned into a depth of 40 mm throughout and stitched in such a manner that it is possible to insert a cotton tape through the waist-band.

3.3 Front Opening — The front opening shall be positioned at 12 cm from the centre of the crutch piece as shown in Fig. 1. The under layer shall be reinforced with cotton calico and the inner edge of the top layer shall be reinforced with cotton tape.

3.4 Crutch Piece — The fabric used for crutch piece shall be of same type and construction as that of the underpant (leg portion). The crutch piece shall be reinforced throughout with cotton calico. The crutch piece and the reinforcement fabric shall be scoured or bleached as the underpants.

3.5 Seams and Stitches

3.5.1 The sewing details of the underpant shall be as under:

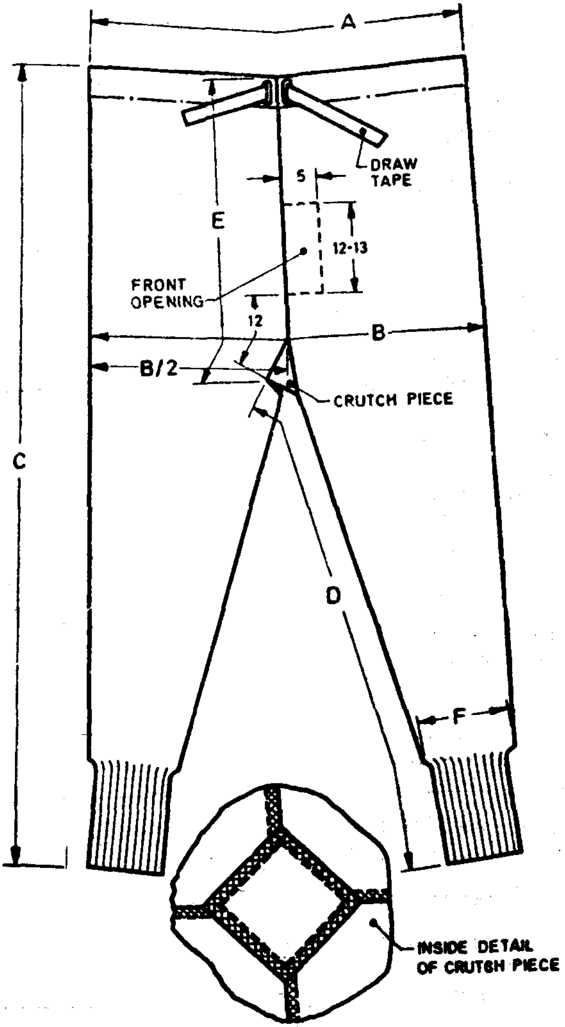
Portion to be Stitched	*Type of Stitch*	*Sewing Thread*
i) All joinings	Flat-lock	Three strands of cotton sewing threads 60s/3 count (100 dtex × 3) or 40s/2 count (145 dtex × 2) in the needle and one strand of same sewing threads in each of the two loopers
ii) Flap at the front opening	Lock stitch	One strand of cotton sewing thread of 60s/3 count (100 dtex × 3) or 40s/3 count (145 dtex × 2) in each of the needle and the looper'

NOTE — Sewing thread of 60s/3 (100 dtex × 3) count may be used in place of 40s/2 (145 dtex × 2) count.

3.5.2 The stitches shall be of even tension, throughout and all the loose ends securely fastened off. The number of stitches shall not be less than 5 per centimetre. The seams and joins shall withstand stretching in all directions to the full extent of the knitted fabric.

4. REQUIREMENTS

4.1 Dimensions and Mass — The underpants shall conform to the requirements of Table 1 read with Fig. 1.



All dimensions in millimetres.

FIG. 1 TYPICAL UNDERPANTS

TABLE 1 DIMENSIONS AND MASS OF WOOL-COTTON UNDERPANTS

(*Clause* 4.1)

SIZE	WIDTH ACROSS WAIST	WIDTH ACROSS SEAT (MEASURED AT THE TOP OF THE CRUTCH PIECE)	SIDE LENGTH	INSIDE LEG LENGTH	DEPTH OF FRONT (DISTANCE FROM TOP OF WAIST BAND TO CRUTCH)	WIDTH OF LEG BOTTOM (JUST ABOVE RIB PORTION)	MASS PER 10 UNDER-PANTS (*see* NOTE)
	A	*B*	*C*	*D*	*E*	*F*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	cm	cm	cm	cm	cm	cm	g
75	37·5	40	91	69	31	12	3 110
80	40	42·5	94	71	33	13	3 340
85	42·5	45	97	73	35	13	3 570
90	45	47·5	100	75	37	14	3 800
95	47·5	50	103	77	39	14	4 040
100	50	52·5	107	79	41	14	4 280
105	52·5	55	111	81	43	15	4 520
TOLERANCE	± 1	± 1·5	± 2	± 2	± 1·5	± 1·5	—
METHOD OF TEST	A-2	A-2	A-2	A-2	A-2	A-2	A-3

NOTE — A tolerance of −3 percent on the mass of individual underpant shall be permissible provided the average minimum mass for 10 underpants is maintained.

4.2 The underpants shall also conform to the requirements as given in Table 2.

4.3 The underpants shall be free from the objectionable flaws. The objectionable flaws shall be those which strike immediately the eyes and shall be deemed to include:

a) Appearance of cotton yarn on the face of the fabric;
b) Noticeable broken thread in the body;
c) Conspicuous broken pattern;
d) Large mends;
e) Ladders;

f) Dropped stitches;
g) Noticeable oil or other stains;
h) Holes, cuts or tears extending beyond 6 mm square in area;
j) Missed stitches at the stitched portion;
k) Improper reinforcement; and
m) Any other defect which would significantly mar the appearance or serviceability.

TABLE 2 REQUIREMENTS OF WOOL-COTTON UNDERPANTS

(*Clause* 4.2)

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
(1)	(2)	(3)	(4)
i)	Wales/dm	60 ± 4	A-4
ii)	Courses/dm	100 ± 4	
iii)	Dimensional change, percent, *Max*	5·0	A-5
iv)	*p*H value of aqueous extract:		IS : 1390-1961* (cold method)
	a) Worsted yarn	5·0 to 7·5	
	b) Cotton yarn	6·0 to 8·0	
v)	Scouring loss, percent, *Max*		A-6
	a) Worsted yarn	4·0	
	b) Cotton yarn	3·0	
vi)	Blend composition (excluding, bottom of leg portion)		IS : 2006-1976†
	a) Wool	55 ± 2 percent	
	b) Cotton	45 ± 2 percent	
vii)	Grade of wool tops	58s or finer	IS : 5911-1977‡

*Methods for determination of *p*H value of aqueous extracts of textile materials.

†Method for quantitative chemical analysis of binary mixtures of protein fibres and certain other fibres (*first revision*).

‡Specification for fineness grades of wool tops.

4.4 Sealed Sample — In case a sample has been agreed upon and sealed to illustrate or specify the indeterminable characteristics, such as general appearance, feel and type of finish, the supply shall be in conformity with the sample in such respects.

4.4.1 The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

5. MARKING

5.1 A suitable cloth label shall be securely stitched to each piece on the inside of the waist (back side) on which the following shall be marked:

a) Name of the material, namely, ' Wool-Cotton Underpants';

b) Size;

c) Manufacturer's name, initials or trade-mark, if any; and

d) Any other information required by the buyer.

5.1.1 The underpants may also be marked with the ISI Certification Mark.

Note — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. PRESERVATION

6.1 The underpants shall be preserved with a heavy dose of naphthalene, using a minimum quantity of 5 kg/m^3 of the volume of the bale.

7. PACKING

7.1 The underpants of the same size and shape shall be packed in a bale in accordance with IS : 2518-1964* or IS : 3353-1966†, as the case may be.

7.2 Alternatively, the underpants may be packed by the method given below, when specifically agreed to between the buyer and the seller:

> Ten underpants of the same size and shape, suitably folded, would be tied with twine or string to form a bundle. Five such bundles shall be wrapped with an inner layer of polyethylene film of minimum 40 µm (*see* IS : 2508-1963‡) or kraft paper (*see* IS : 1397-1967§) and an outer layer of heavy cee cloth (*see* IS : 3751-1966||) or equivalent hessian cloth to form a rectangular bale.

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*Code for seaworthy packaging of wool hosiery yarn and goods.

†Code for inland packaging of wool hosiery yarn and goods.

‡Specification for low density polyethylene films.

§Specification for kraft paper (*first revision*).

||Specification for heavy cee cloth.

The overlaps of the inner layer shall be at least 10 cm to ensure full protection of the contents of the bale. The overlaps of the outer layer of heavy cee cloth or hessian shall be such that it can be properly and securely sewn around the bale. The bale shall be stitched with double 3-ply jute twine with not less than 12 stitches per decimetre taking care not to pierce inner wrappings during stitching. Sufficient heavy cee cloth or hessian shall be pulled out at each corner to form ears of about 15 cm in length. The bale shall be made secure by fastening with at least two bands of steel strips (loops) or metal wire in each direction along the length and width of the bale.

8. SAMPLING

8.0 The sampling procedure given below shall give desired protection to the buyer and the seller provided that the lot submitted for inspection is homogeneous. To achieve this, the manufacturer shall maintain a system of process control at all stages of manufacture and shall ensure that the underpants tendered by him for inspection comply with the requirements of this standard in all respects.

NOTE — For effective process control the use of statistical quality control techniques is recommended and a helpful guidance may be obtained in this respect from IS : 397 (Part I)-1972* and IS : 397 (Part II)-1975*.

8.1 Lot — In any consignment all the underpants of the same size shall constitute a lot.

8.1.1 The conformity of the lot to the requirements of this specification shall be determined on the basis of the tests carried out on the samples selected from it.

8.2 Unless otherwise agreed to between the buyer and the seller, the number of underpants, depending upon the size of the lot, shall be selected at random in accordance with col 2 of Table 3.

8.3 The number of tests and criteria for conformity for each of the characteristics shall be as follows:

Characteristics	*Number of Tests*	*Criteria for Conformity*
Dimensions, wales and courses and freedom from defects	*See* col 2 of Table 3	Number of nonconforming underpants shall not exceed the corresponding number given in col 3 of Table 3

---

*Method for statistical quality control during production:

Part I Control charts for variables (*first revision*).

Part II Control charts for attributes and count of defects (*first revision*).

Characteristics	*Number of Tests*	*Criteria for Conformity*
Mass	Equal to the number of sets of ten underpants formed from the underpants selected according to col 2 of Table 3	All the observations shall satisfy the relevant requirements
Dimensional change, *p*H value of aqueous extract, scouring loss blend composition and grade of wool tops	*See* col 4 of Table 3	Number of non-conforming underpants shall not exceed the corresponding number given in col 5 of Table 3

TABLE 3 NUMBER OF UNDERPANTS TO BE SELECTED FROM A LOT AND PERMISSIBLE NUMBER OF NON-CONFORMING UNDERPANTS

(*Clause* 8.2)

NUMBER OF UNDERPANTS IN THE LOT	NON-DESTRUCTIVE TESTING		DESTRUCTIVE TESTING	
	Number of Underpants to be Inspected	Permissible Number of Non-conforming Underpants	Number of Underpants to be Inspected	Permissible Number of Non-conforming Underpants
(1)	(2)	(3)	(4)	(5)
Under 50	10	0	2	0
51 to 100	20	0	2	0
101 ,, 200	30	1	2	0
201 ,, 300	40	1	3	0
301 ,, 500	50	2	5	0
501 ,, 800	70	2	7	0
801 ,, 1 300	110	3	10	0
1 301 ,, 3 200	150	4	15	0
3 201 and above	220	5	30	1

APPENDIX A

(*Tables* 1 *and* 2)

METHOD OF TEST

A-1. CONDITIONING OF TEST SPECIMENS AND ATMOSPHERIC CONDITIONS FOR TESTING

A-1.1 The test specimens shall preferably be conditioned for testing and tested in the standard atmosphere as given in IS : 6359-1971*.

A-2. DIMENSIONS

A-2.1 Take an underpant constituting the test sample (*see* **8.3**). Lay it flat on a horizontal surface. Remove all creases and wrinkles without distorting it. Measure correct to the nearest millimetre the dimensions given in Table 1.

A-3. MASS

A-3.1 Take a set of 10 underpants constituting the test sample (*see* **8.3**). Condition them to moisture equilibrium for 24 hours (*see* **A-1.1**) and weigh to an accuracy of 10 g. Also determine the mass of individual underpant.

A-4. WALES AND COURSES

A-4.1 Take an underpant constituting the test sample (*see* **8.3**). Lay it flat on a horizontal surface. Remove all creases and wrinkles without distorting it. Count with the help of a pick glass or magnifying glass, the number of wales and courses per decimetre of the fabric at five different places and calculate the average.

A-5. DIMENSIONAL CHANGE (DUE TO RELAXATION)

A-5.1 Marking of Test Specimens — Take one of the pieces from the test sample (*see* **8.3**). Mark centrally on it by means of indelible ink or a fast dyed cotton sewing thread an area 15 × 15 cm with two of its sides running in the direction of wales and the other two in the direction of courses. Spread this test specimen on a flat smooth surface, carefully removing by hand all creases and wrinkles. Within this area, mark six pairs of marks, three pairs each in the wales and courses direction in such a way that the distance between each pair of marks is the same.

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*Conditioning of textiles.

A-5.2 Procedure

A-5.2.1 Place test specimen on a glass plate and carefully remove by hand all creases and wrinkles without stretching the test specimen and place the other glass plate on the test specimen. Measure correct to the nearest millimetre, the distance between each pair of marks separately.

A-5.2.2 Lay the test specimen flat in a watertight tray of suitable size, having depth of 10 cm minimum. Soak it under a head of 25 mm of water containing 0·5 percent suitable wetting agent at room temperature (30 to 35°C) for 2 hours. Drain out the water and remove the test specimen carefully so that it is not stretched and lay it flat on a smooth surface. Remove the excess water by absorbent material and dry it at room temperature.

NOTE — Removal of excess water by wringing the test specimen is not permitted.

A-5.2.3 After drying, condition the test specimen to moisture equilibrium at the room temperature. Place it on the glass plate, carefully remove all wrinkles and creases and place the other glass plate on the test specimen. Measure correct to the nearest millimetre, the distance between each pair of marks separately.

A-5.3 Calculation

A-5.3.1 Calculate separately the percentage of dimensional change both in the directions of wales and courses by the following formula:

$$Sr = \frac{100 \times (a - b)}{a}$$

where

Sr = dimensional change (due to relaxation), percent;

a = the distance between a pair of marks (along the wales or courses as the case may be) before soaking; and

b = the distance between the same pair of marks after soaking.

A-5.3.2 Calculate separately the dimensional change (due to relaxation) of all the three lines in the direction of wales and courses and calculate average dimensional change (due to relaxation) in each direction.

A-6. SCOURING LOSS

A-6.1 Test Specimens — Take an underpant from the test sample (*see* **8.3**). Cut the bottom portion. Taking an end of any one of the cut and frayed loops, unravel the worsted and cotton yarn separately.

Collect the yarn so removed separately into convenient bundles. Continue unravelling till about 10 g of worsted and cotton yarn in the form of bundles are accumulated. These shall constitute the test specimens.

A-6.2 Procedure

A-6.2.1 *Worsted Yarn*

A-6.2.1.1 Dry the test specimen to constant mass in the drying oven at 105 ± 3°C temperature and determine its mass accurately.

NOTE — Constant mass shall be deemed to have been reached if the difference between the two successive weighings at an interval of 20 minutes is less than 0·05 percent.

A-6.2.1.2 Extract the above specimen with a mixture of benzene and methyl alcohol in the proportion of 3 : 2 in a Soxhlet apparatus for 4 hours at the rate of 5 extractions per hour, by placing the specimen in a thimble and covering it with cotton wool previously extracted with the above stated mixture of benzene and methyl alcohol in the proportion of 3 : 2. The solvent shall then be distilled off from the extract. Dry the residue to a constant mass (*see* Note under **A-6.2.1.1**) at 105 ± 3°C and determine the mass accurately.

A-6.2.1.3 Calculate the scouring loss of worsted yarn by the following formula:

$$\text{Scouring loss, percent} = \frac{100\,a}{b}$$

where

a = mass of the dry residue (*see* **A-6.2.1.2**).
b = mass of the test specimen (*see* **A-6.2.1.1**).

A-6.2.2 *Cotton Yarn* — Determine the scouring loss of test specimen by following the procedure prescribed for mild method in IS : 1383-1977*.

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*Methods for determining scouring loss of cotton textile materials (*first revision*).

APPENDIX B

(*Clause* 0.3)

SI UNITS

TABLE 4 INTERNATIONAL SYSTEM UNITS

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

TABLE 5 RECOMMENDED SI UNITS FOR TEXTILES

Sl No.	Characteristic	SI Unit(s)		Application
		Unit(s)	Abbreviation(s)	
(1)	(2)	(3)	(4)	(5)
1)	Length	Millimetre	mm	Fibres
		Millimetre, centimetre	mm, cm	Samples, test specimens (as appropriate)
		Metre	m	Yarns, ropes, cordages, fabrics
2)	Width	Millimetre	mm	Narrow fabrics
		Centimetre	cm	Other fabrics
		Millimetre, centimetre	mm, cm	Samples, test specimens (as appropriate)
		Centimetre, metre	cm, m	Carpets, druggets, *DURRIES* (as appropriate)
3)	Thickness	Micrometre (micron)	µm	Delicate fabrics
		Millimetre	mm	Other fabrics, carpets, felts
4)	Linear density	Tex	tex	Yarns
		Millitex	mtex	Fibres
		Decitex	dtex	Filaments, filament yarns
		Kilotex	ktex	Slivers, ropes, cordages
5)	Diameter	Micrometre (micron)	µm	Fibres
		Millimetre	mm	Yarns, ropes, cordages
6)	Circumference	Millimetre	mm	Ropes, cordages
7)	Threads in fabric:			Woven fabrics (as appropriate)
	a) Lengthwise	Number per centimetre	ends/cm	
		Number per decimetre	ends/dm	
	b) Widthwise	Number per centimetre	picks/cm	
		Number per decimetre	picks/dm	
8)	Warp threads in loom	Number per centimetre	ends/cm	Reeds
9)	Stitches in the knitted fabric:			Knitted fabrics (as appropriate)
	a) Lengthwise	Courses per centimetre	courses/cm	
		Courses per decimetre	courses/dm	
	b) Widthwise	Wales per centimetre	wales/cm	
		Wales per decimetre	wales/dm	

(*Continued*)

TABLE 5 RECOMMENDED SI UNITS FOR TEXTILES — *Contd*

Sl No	Characteristic	SI Unit(s)		Application
		Unit(s)	Abbreviation(s)	
(1)	(2)	(3)	(4)	(5)
10)	Stitch length	Millimetre	mm	Knitted fabrics Made-up items
11)	Mass per unit area	Grams per square metre	g/m^2	Fabrics
12)	Mass per unit length	Grams per metre	g/m	Fabrics
13)	Twist	Turns per centimetre	turns/cm	Yarns, ropes (as appropriate)
		Turns per metre	turns/m	
14)	Test or gauge length	Millimetre, centimetre	mm, cm	Fibres, yarns and fabric specimens (as appropriate)
15)	Breaking load	Millinewton	mN	Fibres, delicate yarns (individual or skeins)
		Newton	N	Strong yarns (individual or skeins), ropes, cordages, fabrics
16)	Breaking length	Kilometre	km	Yarns
17)	Tenacity	Millinewton per tex	mN/tex	Fibres, yarns (individual or skeins)
18)	Twist factor or twist multiplier	Turns per centimetre × square root of tex	turns/cm $\times \sqrt{\text{tex}}$	Yarns (as appropriate)
		Turns per metre × square root of tex	turns/m $\times \sqrt{\text{tex}}$	
19)	Bursting strength	Newton per square centimetre	N/cm^2	Fabrics
20)	Tear strength	Millinewton Newton	mN N	Fabrics (as appropriate)
21)	Pile height	Millimetre	mm	Carpets
22)	Pile density	Mass of pile yarn in grams per square metre per millimetre pile height	g/m^2/mm pile height	Pile carpets
23)	Elastic modulus	Millinewton per tex per unit deformation	mN/tex/unit deformation	Fibres, yarns, strands

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